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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	)		
Applicant: **HEED**, Björn	)	Examiner:	Leonard R. Leo
Serial No.: 08/737,042	)	Art Unit:	3743
Filed: October 30, 1996	)		

For: HEAT EXCHANGER AND METHOD FOR ITS MANUFACTURE

Attorney Docket No.: 5098

R E S P O N S E AND REQUEST FOR EXTENSION OF THE TERM

Hon. Commissioner of Patents
and Trademarks
Washington, D. C. 20231

September 11, 2000

Sir:

This communication is in response to your Office Action dated May 22, 2000, please amend the application as follows:

IN THE CLAIMS:

Please add claims 12 and 13:

R.1.126

12) A recuperative heat exchanger as claimed in claim 5 wherein:

Said casing is sealed at said top and bottom ends by covering elements.

13) A recuperative heat exchanger as claimed in claim 12 wherein:

Said covering elements are formed from a compound which solidifies upon cooling or by chemical reaction.

The Examiner rejected Claim 5 under 35 U.S.C. § 103(a) as unpatentable over *Davis* in view of *Jenssen*.

The Examiner states that *Jenssen* discloses corrugations 13 b extending the entire width of the planar elements. Appearing only in figure 4, the corrugations 13 b clearly do not extend the entire width of the planar elements.

Efficiency of heat exchangers may be increased by increasing the surface area of heat exchange as in *Davis*. In addition, as in *Jenssen*, efforts can be made so that all of the existing surface area is utilized for heat exchange. *Jenssen* mentions that corrugations may be uniformly made along the whole length of the plate but then immediately teaches against this statement by stating that for manufacturing reasons, the corrugations are formed extending relative to the longitudinal center line of the strip (column 2 line 64 – column 3 line 12, figure 3). Further *Jenssen* continues to teach away from corrugations uniformly formed along the length of the plate by describing how the fluid flows across the heat exchange surfaces should adjusted by varying the corrugations density and/or angle in the shortest path to increase flow resistance, thereby equalizing the fluid flow of the shortest path with the longest path's fluid flow. *Jennsen* admits that this method is impractical, as it requires that the corrugation pattern be redesigned and the heat exchanger remanufactured to match each media and flow rate combination (Column 3, line 36 - Column 4, line 1). In addition, the recommended varied ridge angles in the shortest flow path have the opposite effect on media on the other side of the plate, decreasing flow resistance in the shortest path and increasing it in the longest path thereby negating the purpose of the varied ridge angles in the first place.

The present, non-obvious invention introduces a third efficiency component, turbulence. Turbulent flow throughout the flow path of Applicant's heat exchanger is created by wave-shaped corrugations angled at more than 45° with respect to the length dimension of the heat exchange element. No mention of any angle is given in either cited reference. The obtuse angle creates a turbulent flow situation where each particle of flowing fluid changes direction transversely in a manner which leads to an optimal balance between the increased residence time in the heat exchanger and resulting pressure drop.

Of great importance is that the obtuse angle makes the flow resistance to sideways flow less than the flow resistance to forward flow. This ensures that the flow distribution will be even across the whole exchange surface. Any tendency of unevenness in flow density between two parallel paths along the surface will immediately be counteracted by some of the flow moving sideways from the more dense stream to the less dense. Such even flow on both sides of the heat exchanger surface is essential for the achievement of good heat recovery. Long and short flow paths, as taught by *Jenssen*, have negligible effect in this environment. The practical effect is to reduce

concentrated hot regions in the exchanger and to expose the counter-flowing fluids to each other in a manner which optimizes the heat transfer between them, satisfying the present, non-obvious invention's objective of optimal heat exchange.

Compared to *Jenssen*, the present invention's uniform corrugations, extending unbroken across the entire plate not only ensure better performance but also represent a major cost of manufacture savings as the same simplified tooling may be used to create heat exchangers of multiple widths.

As neither *Jenssen* nor *Davis* include, teach or suggest these novel, non-obvious features of the present invention, and in fact teach away from the element cited by the Examiner, rejection under 35 U.S.C. § 103(a) is improper.

Another inefficiency found in *Jenssen* is the numerous welds required to seal the opposing media paths of the heat exchange bundle from each other.

The present, non-obvious invention requires no welds to seal the heat exchange bundle (specification page 4 lines 3-17). Added Claims 12 and 13 claim this novel, non-obvious lower cost of manufacturing feature.

Applicant asserts that all of the objections have been obviated, and therefore now respectively requests withdrawal of the objections and allowance of the application.

REQUEST FOR EXTENSION OF THE TERM

Applicant respectfully requests an extension of the normal term which expired August 22, 2000, for one months, to September 22, 2000.

Submitted herewith is a check for $55 to cover the cost of the extension.

Any deficiency or overpayment should be charged or credited to Deposit Account No. 04-2219, referencing our Docket No. 5098.

Respectfully submitted,

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D. C. 20231, on September 11, 2000.

Erin E. Weinner

ADB/ew